

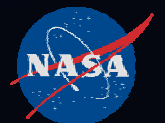
Acoustic Emissions Verification Testing of ISS Experiment Racks at NASA Glenn Research Center Acoustical Testing Laboratory

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The Acoustical Testing Laboratory (ATL)

- Support the development and qualification of low-noise designed space flight hardware.
- Fluids Combustion Facility (FCF) has been the primary customer.
- Open to other NASA and external customers.
- ISO 3744 & 11201 NVLAP Accredited.

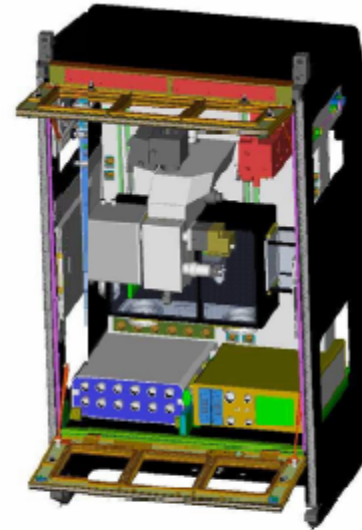


Fluids Combustion Facility

- Supports the study of fluid physics and combustion science in a microgravity environment

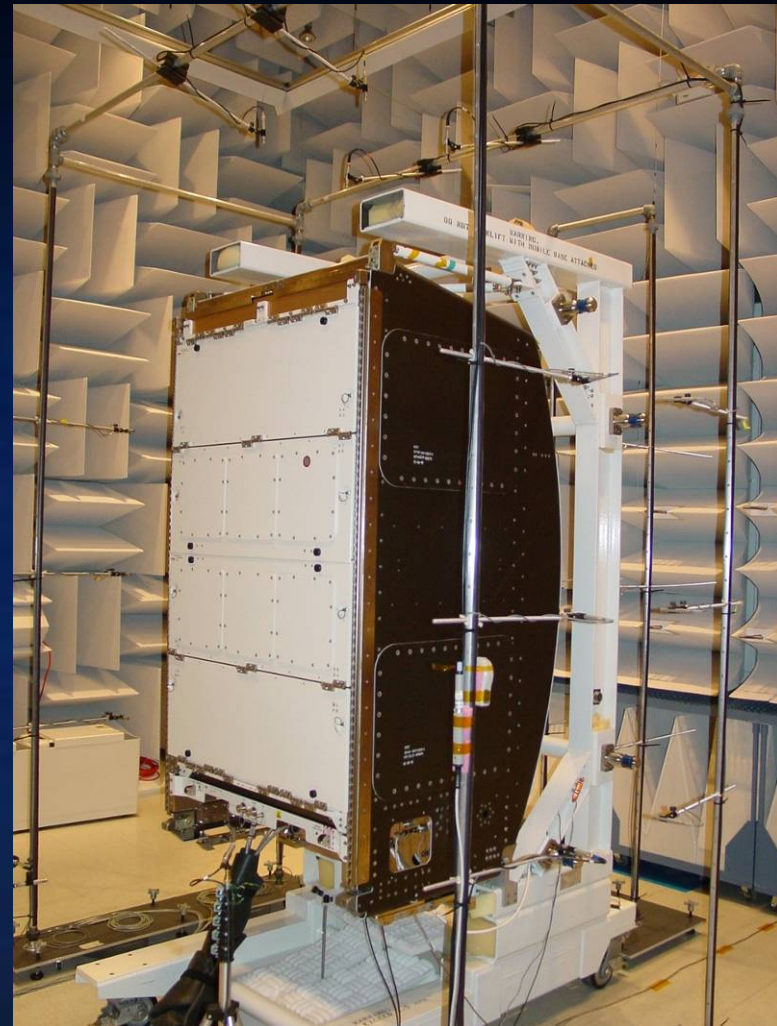
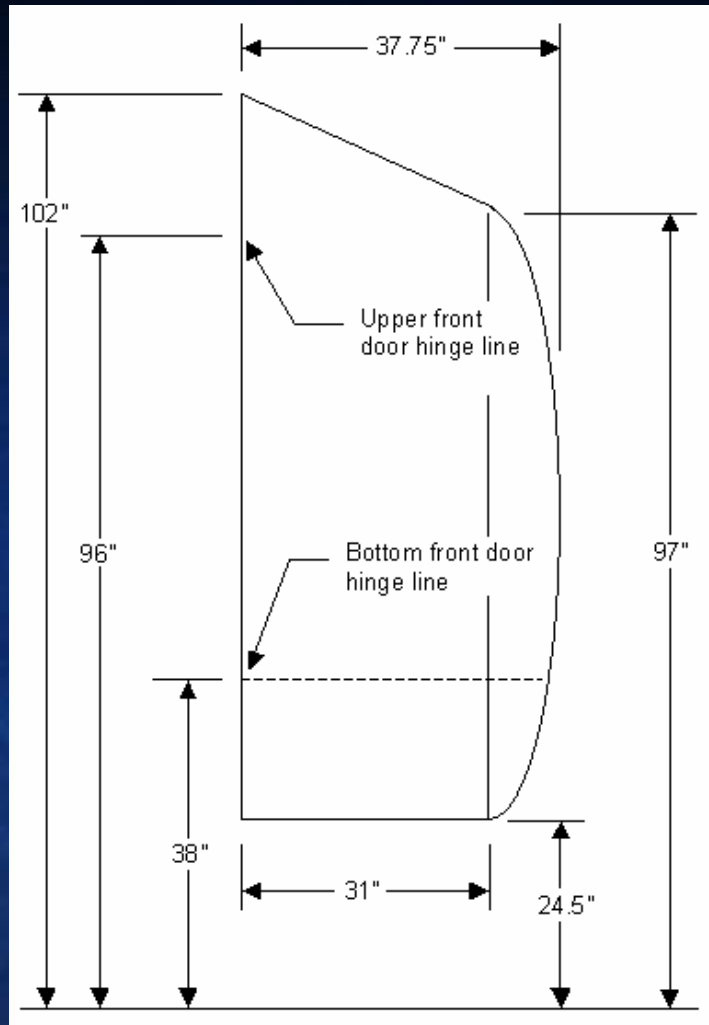


Combustion Integrated
Rack (CIR)



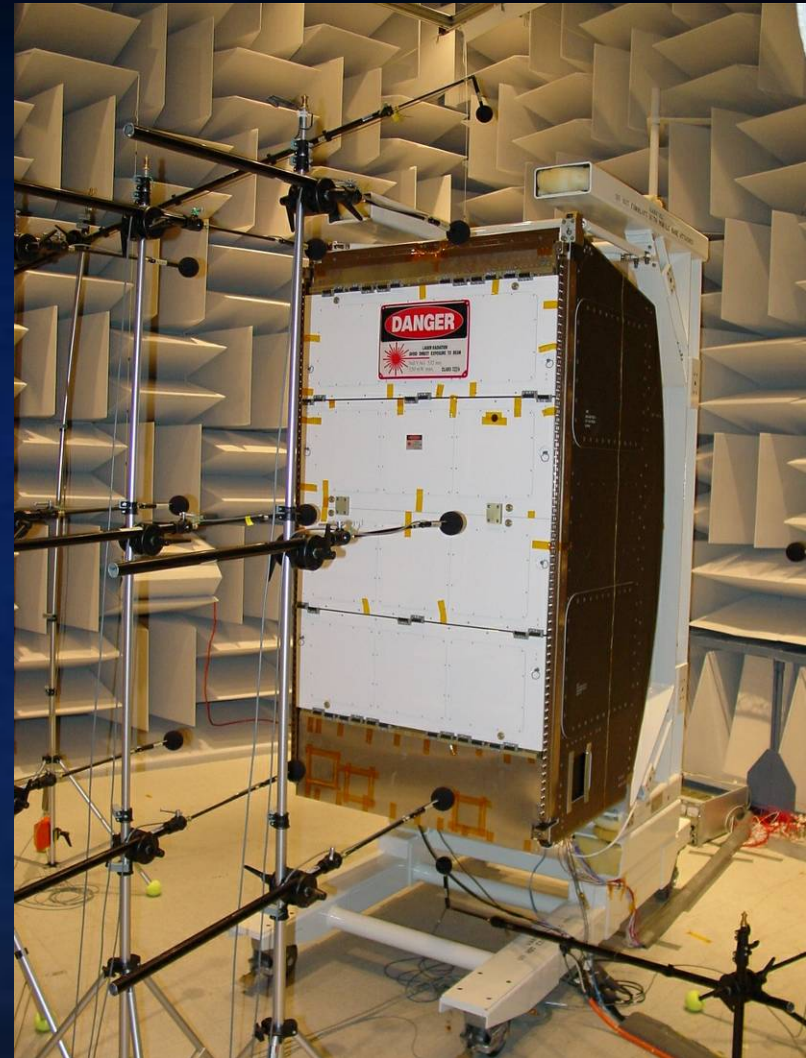
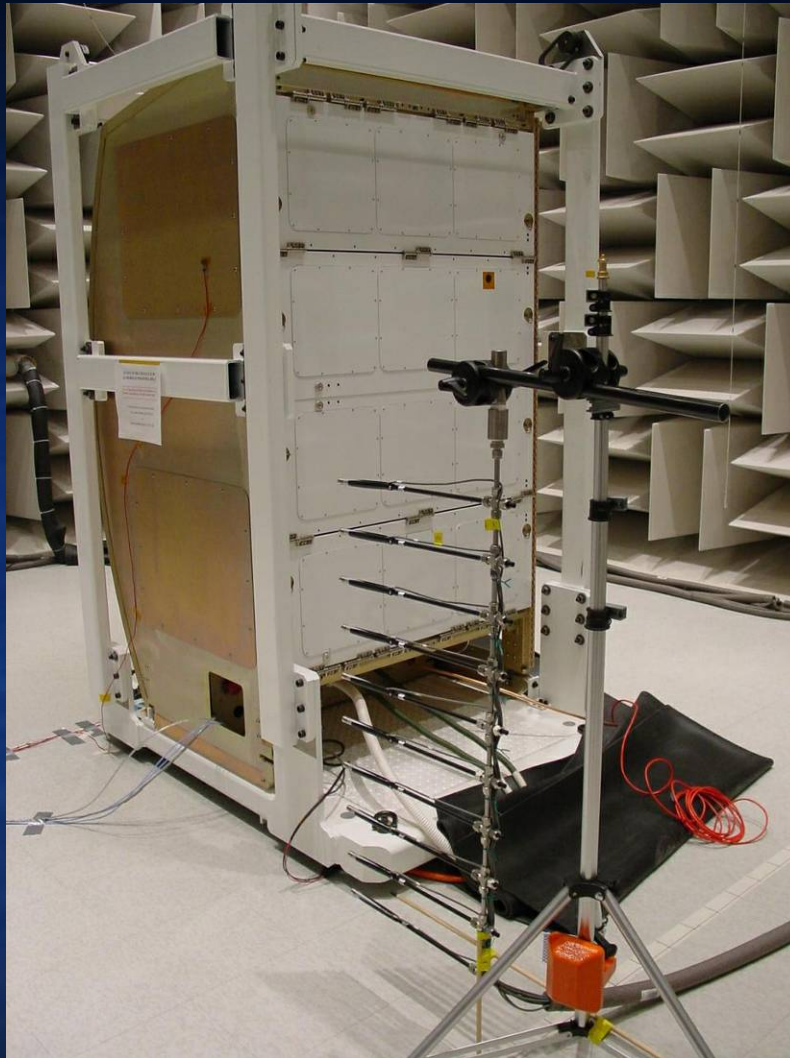
Fluids Integrated Rack
(FIR)

Rack and RHA Dimensions



Total Weight \approx 3000 lbs

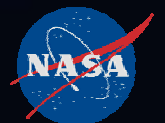
Engineering Models



Component and Subassembly Testing



Glenn Research Center at Lewis Field



NASA SSP 57000 Requirements

Continuous Noise Limits

Octave Band Center Frequency (Hz)	Integrated Rack SPL (dB)
63	64
125	56
250	50
500	45
1000	41
2000	39
4000	38
8000	37

(NC-40 Equivalent)

NASA SSP 57000 Requirements

Intermittent Noise Limits

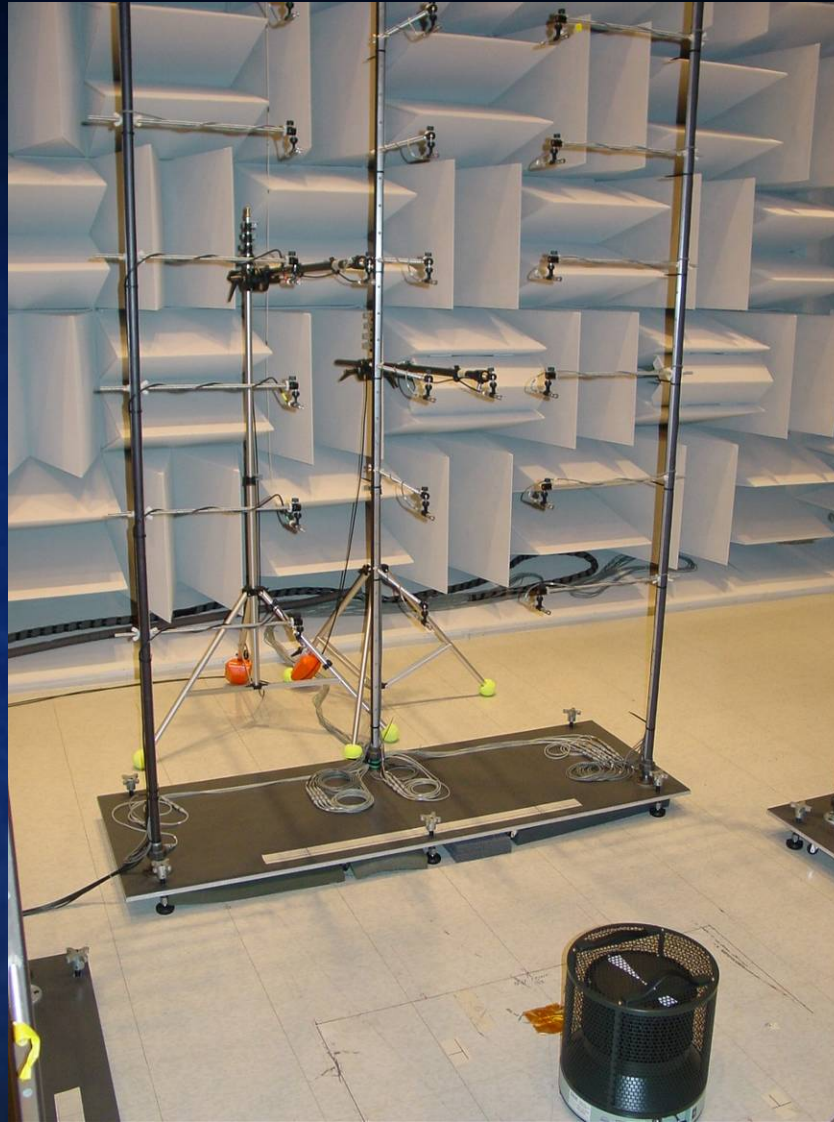
Maximum Noise Duration	Integrated Rack Maximum Overall A-Weighted Sound Level (dBA)
8 Hours	49
7 Hours	50
6 Hours	51
5 Hours	52
4.5 Hours	53
4 Hours	54
3.5 Hours	55
3 Hours	57
2.5 Hours	58
2 Hours	60
1.5 Hours	62
1 Hour	65
30 Minutes	69
15 Minutes	72
5 Minutes	76
2 Minutes	78
1 Minute	79
Not Allowed	80

Method of Positioning Microphones



- Unstable
- Very cluttered
- Difficult to set up
- Set position

Front Microphone Array Fixture

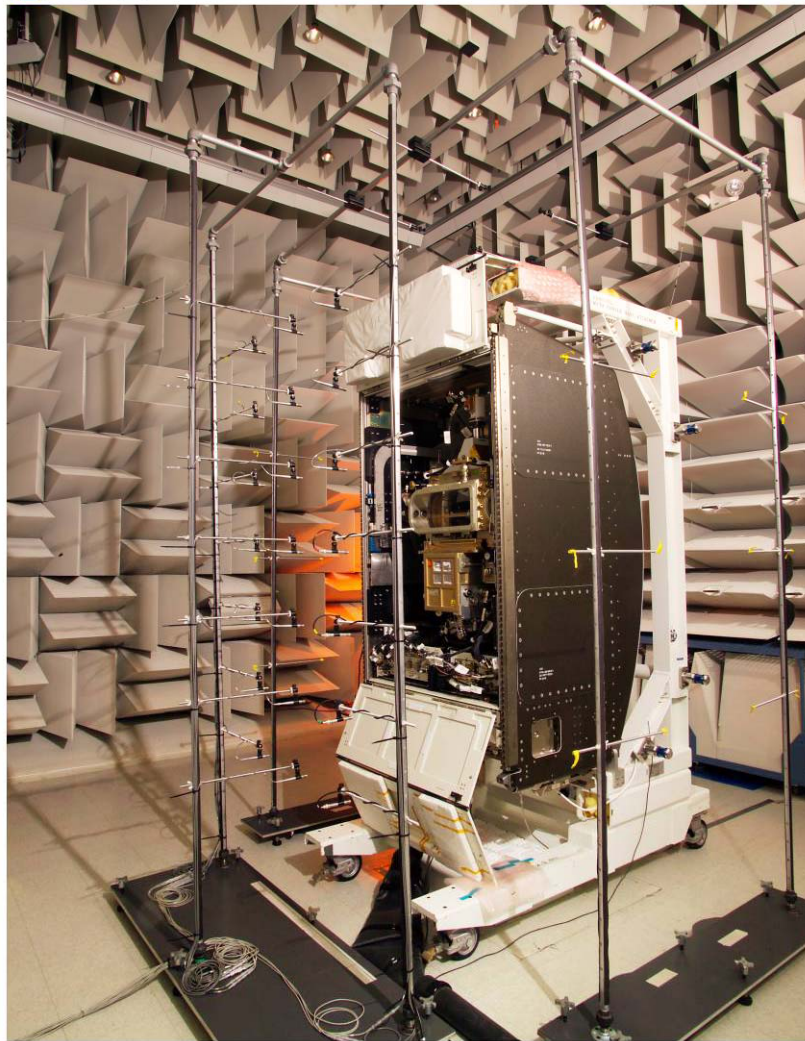


Side-Top Microphone Array Fixture



Final Implementation

NASA
C-2005-139



National Aeronautics and Space Administration
John H. Glenn Research Center at Lewis Field

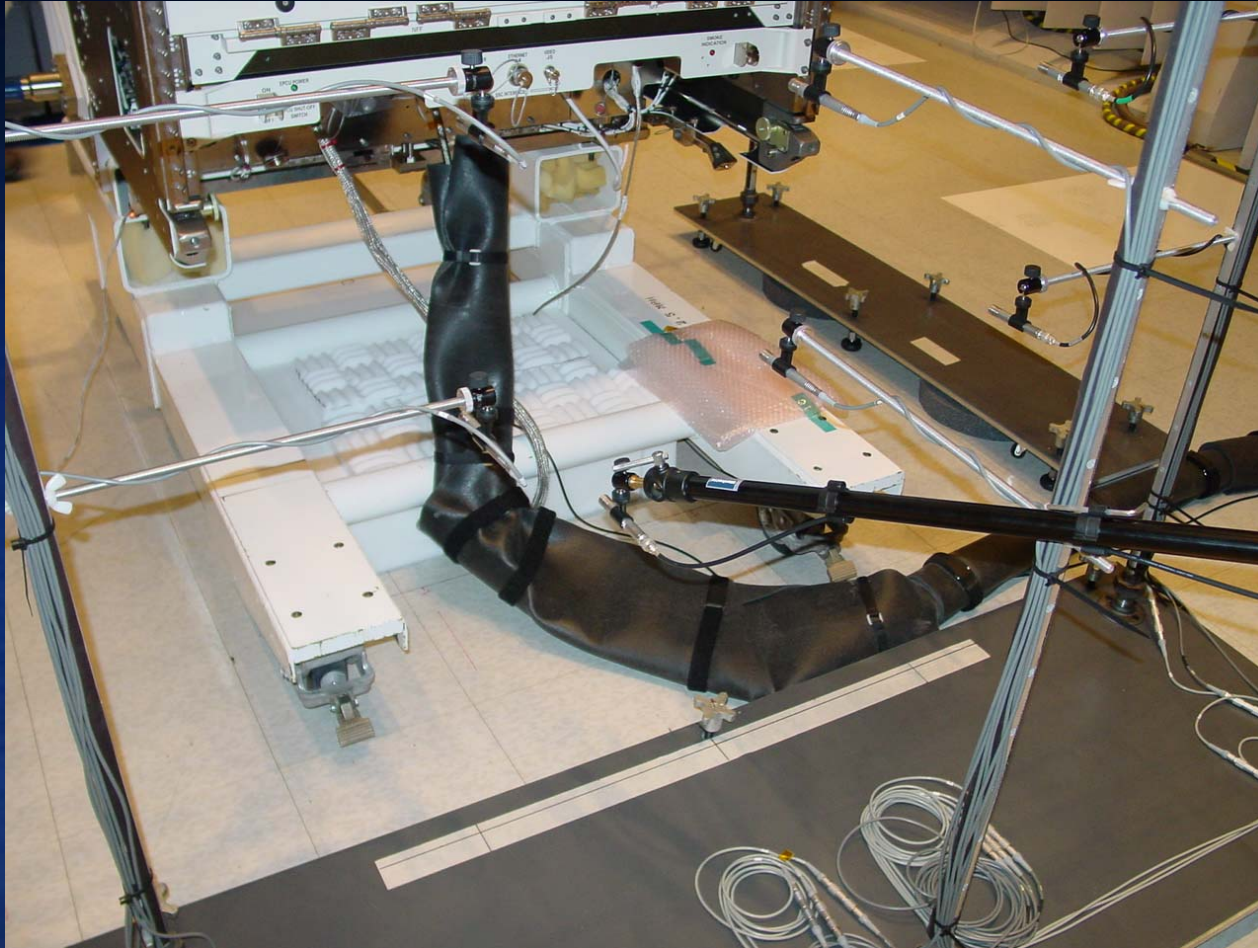
- 21-positions (3-vertical columns with 14 inch lateral and 12 inch vertical spacing)
- Compliance Verification Point microphone (roving).
- Fire Extinguisher microphone.
- Underneath microphone.

Isolation of Ground Support Equipment



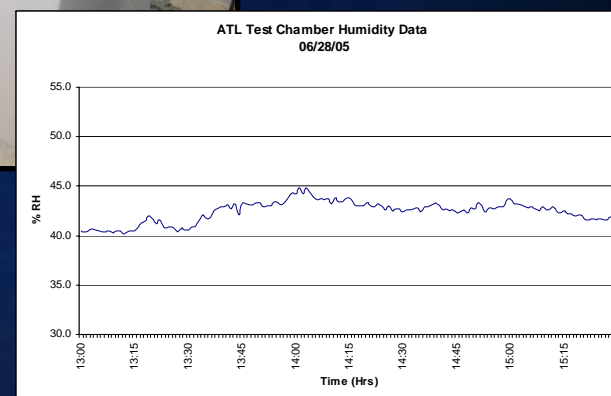
Control room reconfigured into a test enclosure that contains the EPCU power supply and the water chiller cart.

Suppressing Cooling Water Noise



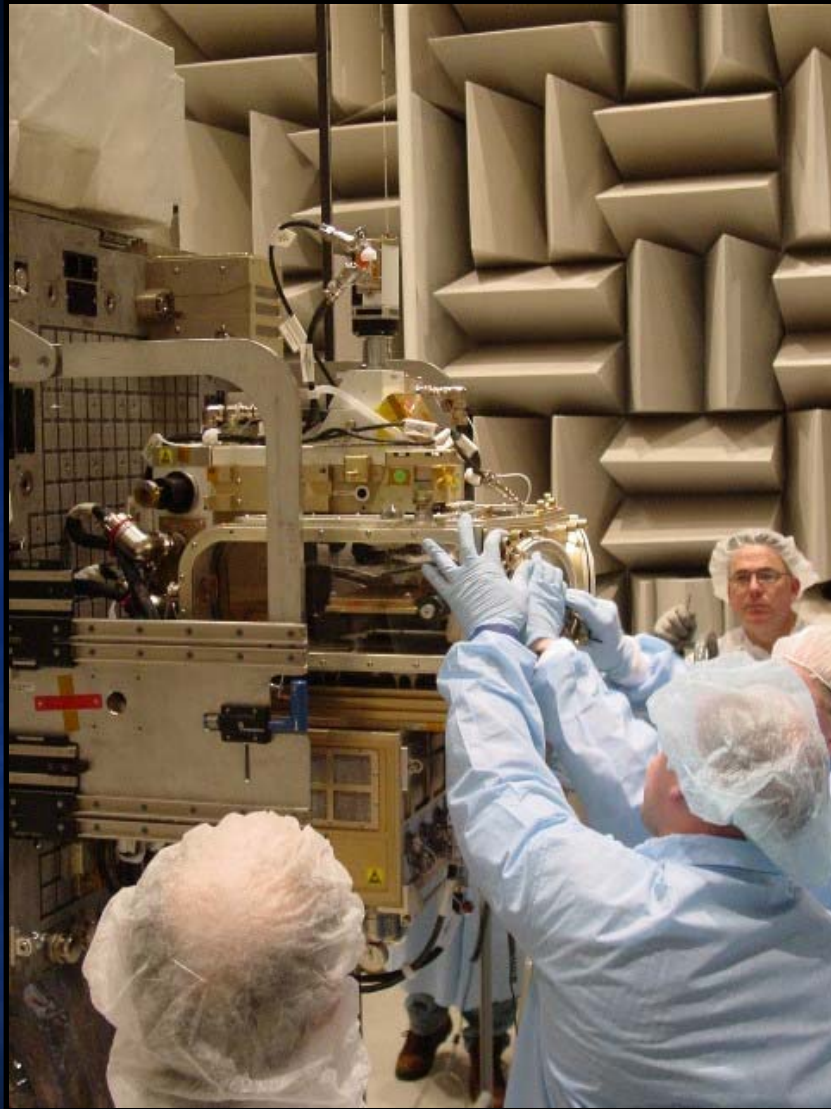
Water Hoses and electrical power cables wrapped in pipe lagging, FIR Flight Rack.

Chamber Humidification Control



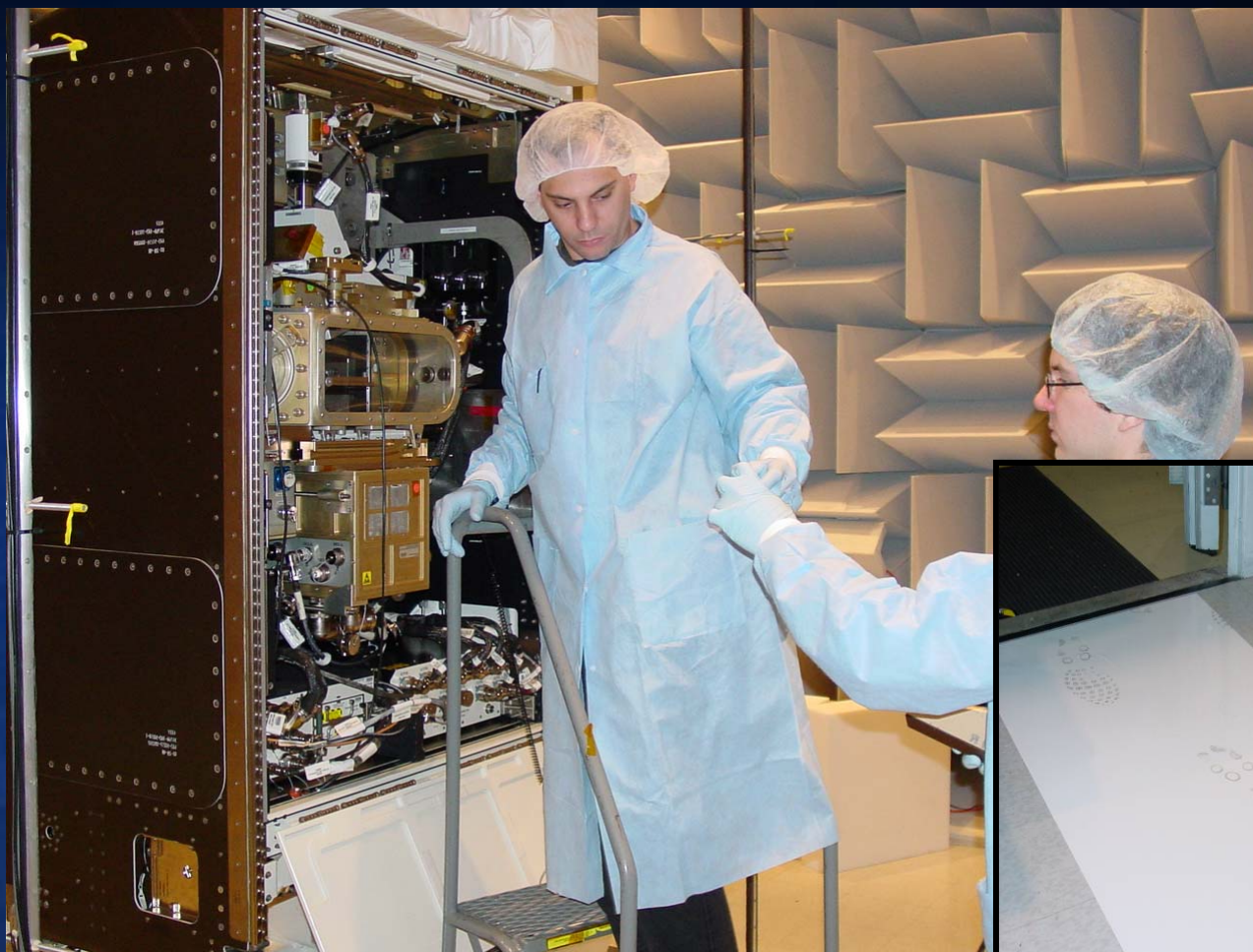
- Maintained at 30 – 50 % RH
- Upper limit to reduce mildew growth
- Logged 1 minute interval
- Chamber humidified between test conditions as needed

ElectroStatic Discharge (ESD) Control

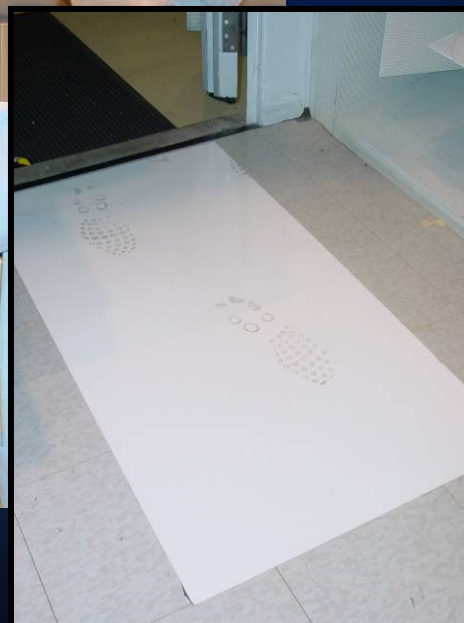


- 30% Relative Humidity
- ESD Smocks
- ESD Gloves
- Grounding Wrist Bands

Contamination Control



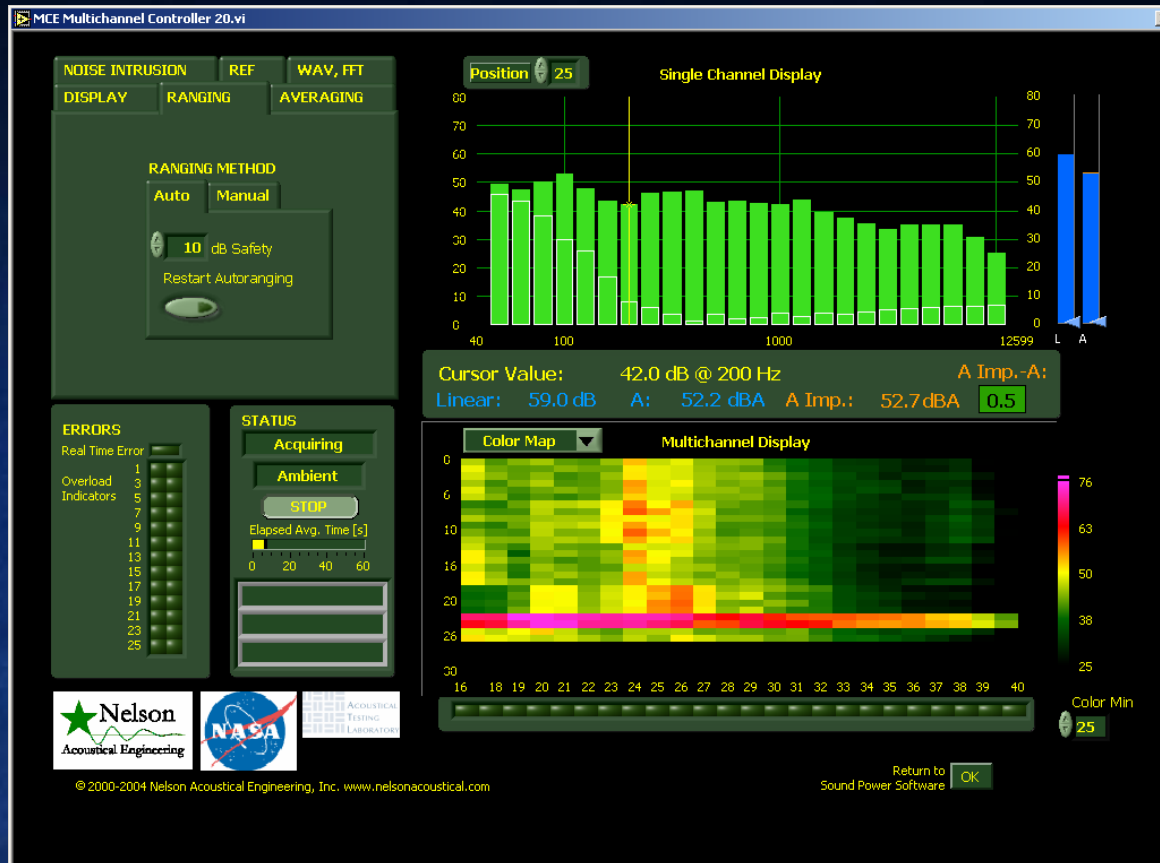
- Smocks
- Hairnets
- Beard Covers
- Gloves
- Sticky Mats



Data Acquisition System



Data Acquisition Window

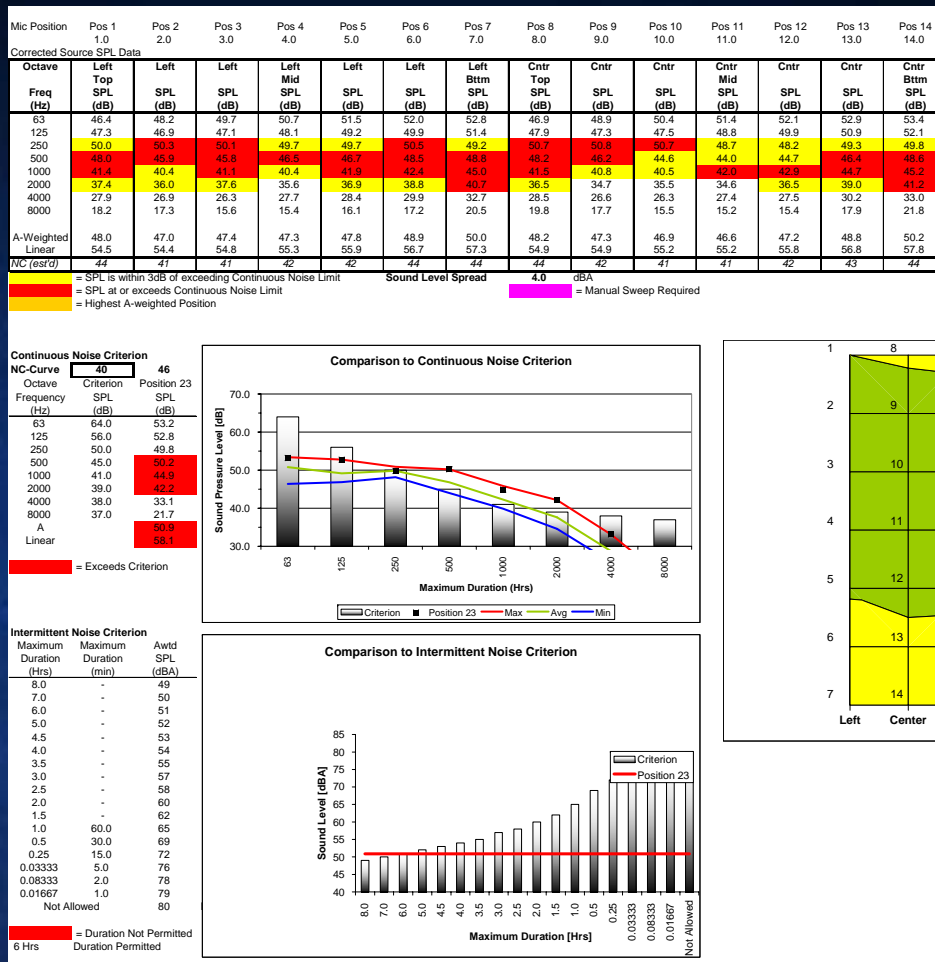


- Narrowband FFT
- Wav files

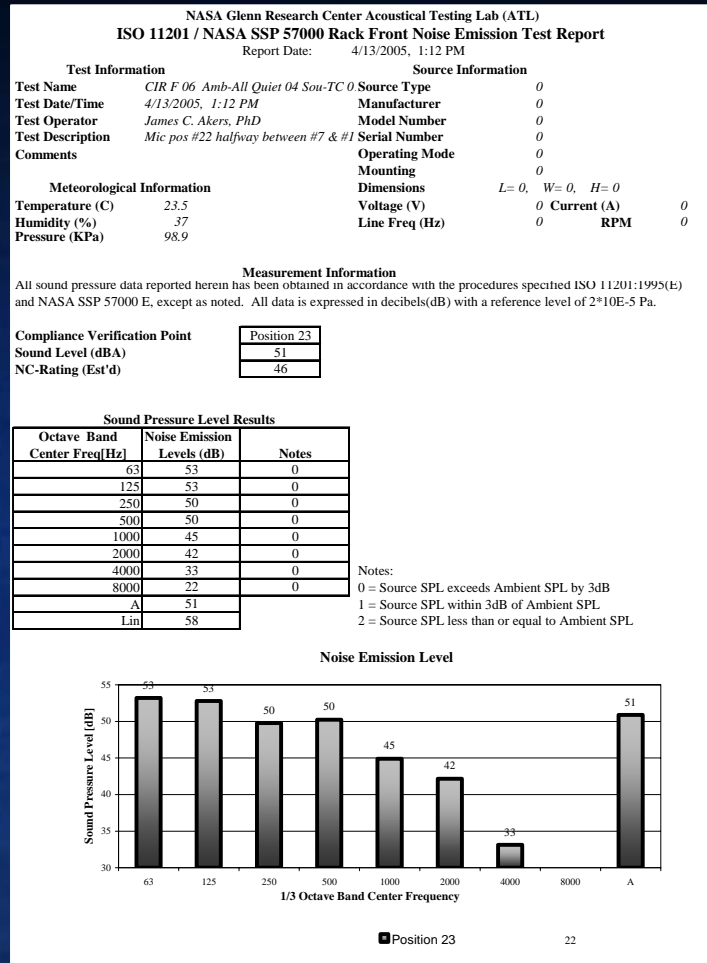
- Noise intrusion alarm
- Ambient norm
- Automatic calibration
- Color map or spread display
- Impulsive indicator

Customized Excel Workbook I

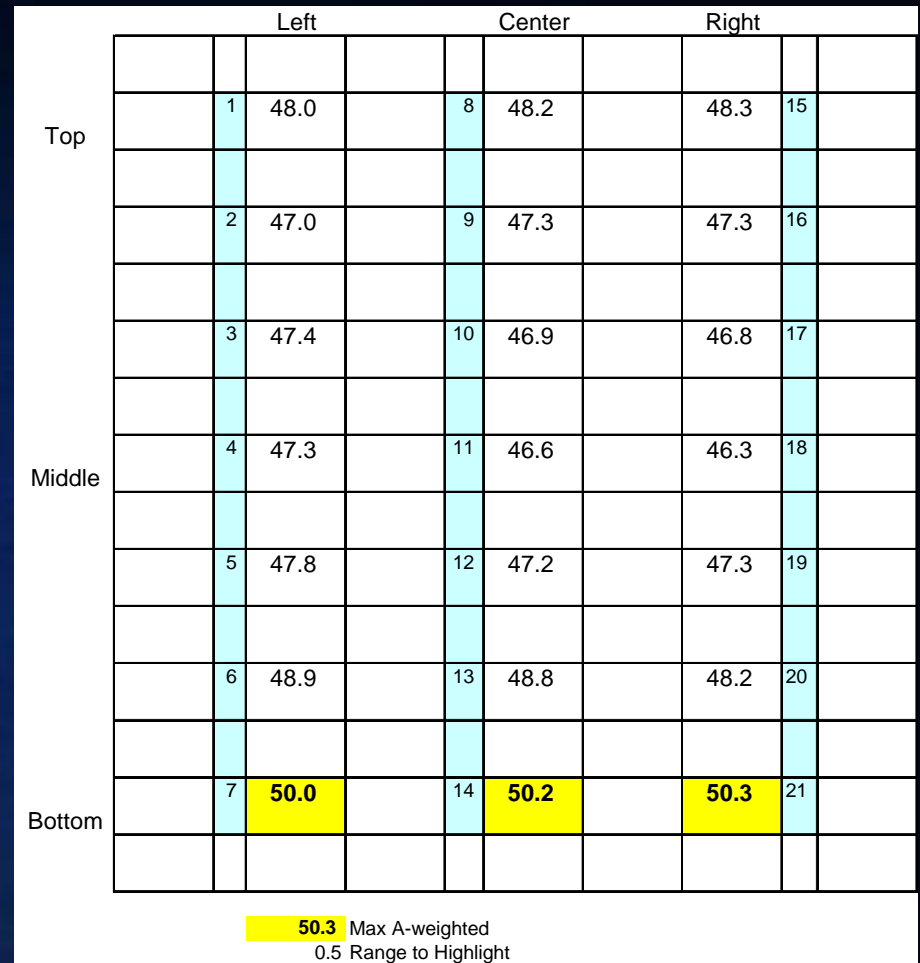
- Color coding.
- Automatic callout of loudest location.
- Comparisons to continuous and intermittent noise limits.



Customized Excel Workbook II



Noise Emission Report



A-wtd sound levels on
front mic array.

ATL Team



NASA
C-2005-552



National Aeronautics and Space Administration
John H. Glenn Research Center at Lewis Field



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